

Plant Analysis Handbook III

A Guide to Sampling, Preparation, Analysis and
Interpretation for Agronomic and Horticultural Crops



Gretchen M. Bryson
Harry A. Mills
David N. Sasseville
J. Benton Jones, Jr.
Allen V. Barker

Gretchen M. Bryson, Ph.D.

CEO, Micro Macro International, Inc.
www.mmilabs.com
Athens, Georgia 30607



Harry A. Mills, Ph.D.

Professor Emeritus University of Georgia
Micro Macro International, Inc.
www.mmilabs.com
Athens, Georgia 30607



David N. Sasseville, Ph.D.

Missouri University Extension and Outreach (retired)
CEO, AgriGuardian
www.AgriGuardian.com
Jefferson City, Missouri 65102



J. Benton Jones, Jr., Ph.D.

Professor Emeritus University of Georgia
GroSystems, Inc.
Anderson, South Carolina



Allen V. Barker, Ph.D.

Professor, Stockbridge School of Agriculture
University of Massachusetts
Amherst, MA 01003



Table of Contents

Chapter 1 – Introduction	1
Chapter 2 – Plant Nutrition Overview	9
Chapter 3 – Factors Affecting Plant Nutrient Composition.....	29
Chapter 4 – Nitrogen (N)	59
Chapter 5 – Phosphorus (P)	71
Chapter 6 – Potassium (K)	81
Chapter 7 – Calcium (Ca)	93
Chapter 8 – Magnesium (Mg)	103
Chapter 9 – Sulfur (S)	109
Chapter 10 – Boron (B)	117
Chapter 11 – Chlorine (Cl)	129
Chapter 12 – Copper (Cu)	133
Chapter 13 – Iron (Fe)	139
Chapter 14 – Manganese (Mn)	145
Chapter 15 – Molybdenum (Mo)	151
Chapter 16 – Zinc (Zn)	161
Chapter 17 – Nickel (Ni)	171
Chapter 18 – Beneficial and Non-Essential Nutrients and Elemental Toxicities	177
Chapter 19 – Foliar Nutrition	185
Chapter 20 – Methods of Elemental Analysis	201
Chapter 21 – Plant Tissue Sampling	211
Chapter 22 – Sample Preparation and Analysis	221
Chapter 23 – Using Plant Tissue Analysis to Improve Crop Performance	229
Chapter 24 – Common Name Index to Nutritional Tables	249
Agronomic & Plantation Crops	249
Bedding Plants	249
Conifers.....	250
Cut Flower Crops.....	251
Ferns & Related Plants	252
Florist Pot Crops	252
Foliage Plants.....	253
Forages and Hay Crops.....	254

Fruit and Nut Crops.....	255
Herbaceous Perennials	255
Herbs	257
Landscape & Forest Trees.....	258
Ornamental Grasses, Sedges, and Bamboos	261
Ornamental Vines and Ground Covers	261
Palms	262
Turfgrasses	262
Vegetables	263
Woody Ornamental Shrubs	264
Crop Nutritional Tables	
Agronomic & Plantation Crops.....	267
Bedding Plants	277
Conifers	285
Cut Flower Crops	299
Ferns & Related Plants.....	304
Florist Pot Crops	309
Foliage Plants	315
Forages and hay Crops	337
Fruit and Nut Crops.....	342
Herbaceous Perennials	353
Herbs	384
Landscape & Forest Trees.....	387
Ornamental Grasses, Sedges, and Bamboos	430
Ornamental Vines and Ground Covers	434
Palms	442
Turfgrasses	445
Vegetables	452
Woody Ornamental Shrubs	478
Literature Cited.....	523
Glossary of Terms	535
Table of Atomic Weights	570